# Integrated Development of Natural Resources on Watershed Basis of Solsinda Micro Watershed for Increased Agricultural Production

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**Abstract**: Various components of dry land technology found suitable in research plots, have been tried in the near by watershed area Solsinda Micro Watershed of Indore, Madhya Pradesh. An attempt has been made to review the impact of some of the technological components on cropping intensity, productivity of different crops and overall development in the watershed. The results of the study led to conclude that dry land technology on watershed basis plays a vital role in enhancing the productivity of different crops on sustainable basis through efficient utilization of available natural resources. The overall impact of watershed development has been considered from base year 1998. The productivity of Soyabeen has been increased by 20%, Wheat by 7.39%, and Chickpeas 42.6% and Potato it was 25.88%. The soil conservation measure viz., diversion drains / bunds loose boulder structures, water harvesting tanks / percolation tanks constructed according to the necessity at proper sites helped in checking soil loss and stabilizing gullies.
**Keywords**: crop productivity, erosion control, watershed development

## 1 Introduction

In India about 70% farming is depend upon rainfall which produce only 42% of the total national food grain. The farmers are mostly small and marginal having poor resources base. Majority of the farmers are illiterate, less enlightened and rather easy going. For them watershed approaches are new and recognized as a means for the overall development, conservation and efficient utilization of natural resources on sustainable basis through watershed development approaches. For these activities involvement of local people is a must. Watershed development programme was initiated with financial assistance of the Asian Development Bank for a project " Improving Management of Natural Resources for Sustainable Rainfed Agriculture" providing an opportunity for partnership research to increase productivity and sustainability of rainfed agriculture in the medium to high water holding capacity soil with the sole objective of increasing the productivity and sustainability of the medium and high water holding capacity soils in the intermediate rainfall eco region and develop environment Active and Friendly participation of farmers has improved management practices that has conserved soil and water resources.

## 2 Materials and methods

The technology for rainfed agriculture generated at All India Coordinated Research Project for Dry land Agriculture Indore Madhya Pradesh was implemented on the farmers fields of Ringnodia Micro Watershed having 390 ha located at 20 km distance from Indore City ( 22° 5′ N and 75° 51′ E) on Indore-Ujjain highway at an altitude of 540 m from the mean sea level (Fig. 1). The watershed is located in the Middle and lower reaches of Khan River. The topography of the Ringnodia Micro Watershed has been divided into three sections a recharge zone (R2) of 18.2 ha with a slope of 8 % and transition zone (T2) with slope of 2.8 % and a cultivated area of 327 ha with a slope of 2 % and comprises medium to deep soils. The mean annual rainfall is 980 mm and soils are clay in texture having high moisture retention capacity having undulating topography. The watershed work has been started in the year 1998—1999 in the upper part. The soils of which was comprised of 215 ha area of typical vestisol synthesized from basaltic parent materials. The soils are fertile and rich in Calcium Carbonate ($CaCO_3$) and are

vulnerable to run off and erosion during intense rains. Soils of the area belong to Class II, III and IV are suitable for improving crop productivity.

## 3 Results and discussion

**Engineering measures for Soil erosion and Run off control**

A brief account of soil conservation measures work in the Ringnodia Micro Watershed area is given below:

**Table 1 Soil and water conservation measure in the watershed area**

| S.No. | Particulars | Area Protected (ha) |
|---|---|---|
| 01 | Loose boulder structure | 30 |
| 02 | Wise-Mesh bound boulder structure | 5 |
| 03 | Water storage structure / percolation tank | 10 |
| 04 | Diversion bund | 215 |
| 05 | Water ways | 15 |
| 06 | Waste weirs | 10 |

As a result of these measures runoff has been controlled the silt and plant nutrients which were being washed away with runoff are being trapped in the field alongwith bunds and loose boulder and wise mesh bound structures.

## 4 Water harvesting and recycling

Table 2 presents the data changes in water potential in the watershed area. The rainwater harvested through various resources development programs in the watershed is being stored in Five water harvesting tanks / percolation tanks of 50000 $m^3$ storage capacity. The catchment area of these $1^{st}$ to $5^{th}$ tanks are 10ha, 20ha,15ha, 150ha, 50 ha respectively. By these soils water conservation measures less water is passing through cultivated fields with low run off potential.

Before starting the project, the life span of shallow well was recorded as 2 to 3 months after the secession of monsoon rains which has been now increased to 6 to 7 months to run off retention and its subsequent deep percolation and enhancing ground water recharge capacity of the wells. There was increased water availability in the watershed due to impounding and recharging of water in the wells consequent upon which the irrigated area has been increased from 30 ha during 1998—1999 to 60 ha during 2000—2001 i.e. almost double.

**Table 2 Improvement in water potential in the watershed area**

| Particulars | 1998—1999 | 2000—2001 |
|---|---|---|
| Surface Water Through tanks | 100 ha • cm | 268 ha • cm |
| Dry well shallow | 13 | 12 |
| Deep Wells (Tube Wells) | 15 | 35 |
| Total irrigated area in percentage | 12 | 58 |

## 5 Forestry and Horticulture

For better utilization degraded lands were put under forestry and horticulture. Under systems fruits and forest trees like jack fruit, papaya, meetha neem, jamun, phalsa and gulmohor, were introduced in 5 ha (Hillock) area of the watershed area.

The barren hillock has been protected from soil losses by planting improved grasses like Dinanath, Cenchrus etc.

## 6 Socio–economic impact

The main sources of income of the sample farmers are through agriculture and labour wages, followed by milk sale and other works. Rates of wages rates are very low, and ranges from Rs. 60 to 70 per day for male and Rs. 45 to 50 per day for female labour.

Land ownership pattern also varies as per the size of holdings. Small and marginal farmers are having cent per cent ownership of their land without any leased land, whereas medium and large sized farmers are leasing their lands. It is evident that medium and large size operational holding fragmented may be due to ceiling act which ultimately increase the number and area of marginal and small categories.

Cropping intensity of the sample farmer was recorded as 122 %, highest in large size group of farmers and lowest i.e. 104 % in small and marginal size group of farmers. Soil type it self a important factor in this regard. As usual small and marginal farmers are having poor soil in their small size of land, where as the rich black soil (Vertisols) lands are in possession of large and medium farmers.

Irrigation is the prime parameter of any watershed development programme. After the adoption of Soil and Water conservation measures, it was found that duration of water supply from the existing tube wells has been increased significantly and more than 50 % area is now under irrigation.

Human resource utilization pattern shows that the family members of small and marginal size group of farmers, are more busy as they have no regular farm service. There was no tractor with these groups, whereas only 18 % of male in large farmers were always engaged in one or another farm activities. They have ample work for bullock and tractors, and about 90 % of the tractors of large farmers are engaged on their own farms.

Apart from the severe drought condition faced by the farmers of Indore District in general and watershed area in particular, there has been a remarkable increase in the productivity level of the major crops in the area, due to the introduction and working of water shed development programme.

**Table 3 Increase in Productivity of different Crops in Micro Watershed area during 1998—1999 and 2000—2001**

| S. No. | Crop. | Size group | Main Produce qtl/hac. | | | By Product qtl/hac | | | Cost-Benefit ratio | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1998—1999 | 2000—2001 | Increase in Percentage | 1998—1999 | 2000—2001 | Increase in Percentage | 1998—1999 | 2000—2001 |
| 01 | Soya-been | Small | 7.00 | 8.50 | 21.43 | 13.00 | 15.00 | 15.38 | 1:1.37 | 1:1.60 |
| | | Medium | 7.50 | 9.20 | 22.67 | 16.00 | 17.00 | 6.25 | 1:1.33 | 1:1.48 |
| | | Large | 8.00 | 9.56 | 19.50 | 20.00 | 17.90 | –10.50 | 1:1.43 | 1:1.45 |
| 02 | Wheat | Small | 16.00 | 16.80 | 5.00 | 18.00 | 18.00 | 0.00 | 1:1.30 | 1:1.75 |
| | | Medium | 24.00 | 25.10 | 4.58 | 28.00 | 27.00 | –3.57 | 1:1.96 | 1:2.15 |
| | | Large | 23.00 | 24.70 | 7.39 | 30.00 | 23.00 | –23.33 | 1:1.98 | 1:2.12 |
| 03 | Chick Peas | Small | 5.00 | 7.10 | 42.00 | 6.00 | 7.50 | 25.00 | 1:1.30 | 1:1.53 |
| | | Medium | 6.00 | 7.90 | 31.67 | 8.00 | 8.40 | 5.20 | 1:1.46 | 1:1.43 |
| | | Large | 6.00 | 8.00 | 33.33 | 8.00 | 8.50 | 6.25 | 1:1.37 | 1:1.47 |
| 04 | Potato | Small | 154.00 | 189.00 | 22.77 | Nil | Nil | Nil | 1:1.77 | 1:2.59 |
| | | Medium | 161.00 | 198.00 | 22.98 | Nil | Nil | Nil | 1:1.84 | 1:2.55 |
| | | Large | 170.00 | 214.00 | 25.88 | Nil | Nil | Nil | 1:1.77 | 1:1.25 |

The present study revels that the watershed approach was having definite impact on the overall

Socio - Economic Condition of the Farmers of Watershed area.

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